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By-Miller, James Hull
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Presents several lighting systems appropriate in size and cost for smaller stages and complets an analysis with production notes explaining in detail lighting projection and design techniques. Contents include--(1) equipment specifications, (2) lighting the actor, (3) light on backgrounds, (4) techniques involving light, (5) design and the quality of iridescence, (6) portable cycs or or background, (7) open stage design, (8) protable scrims, and (9) color media. (RH)

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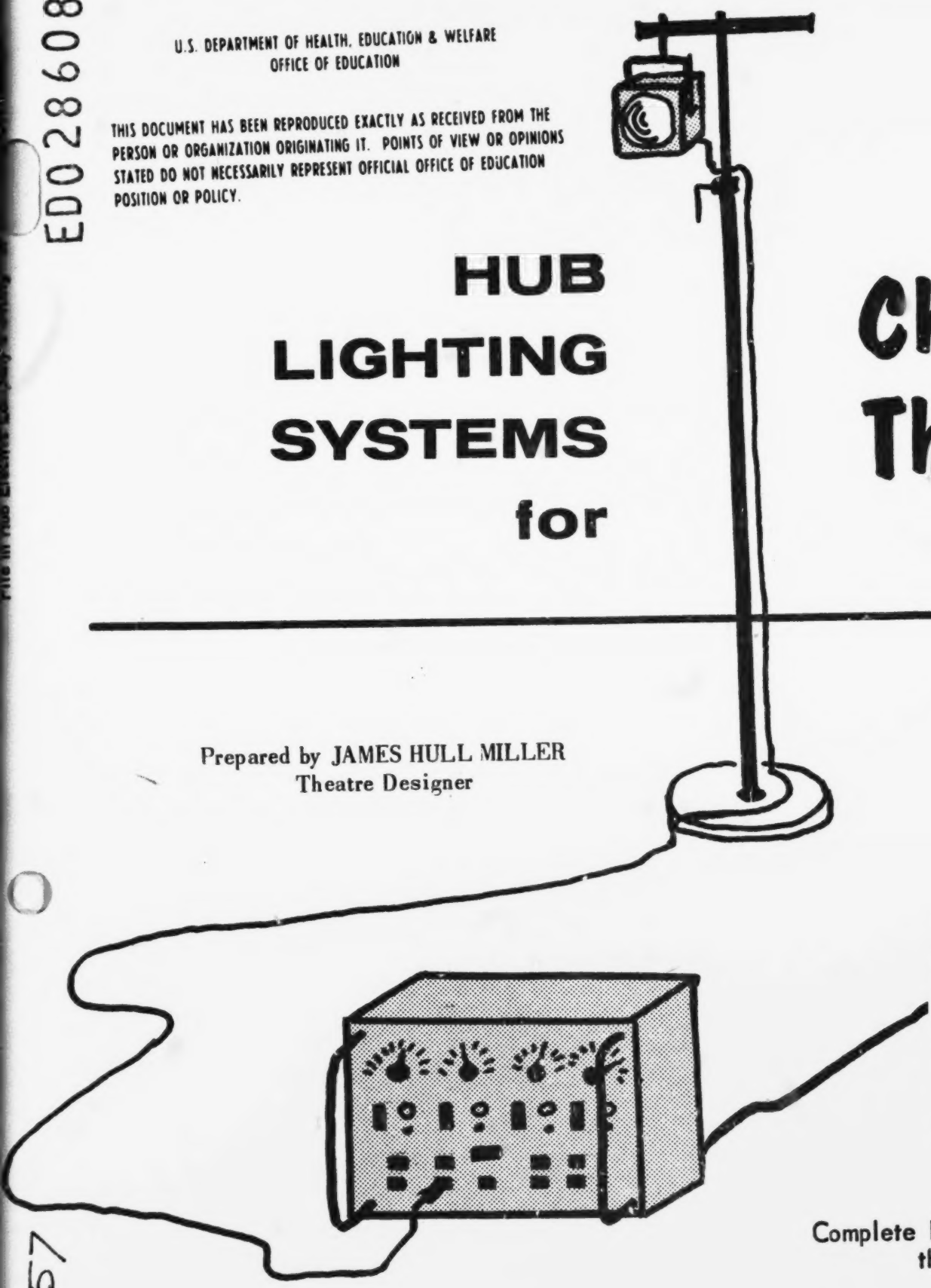
BULLETIN No. 104

HUB LIGHTING SYSTEMS for Children's Theatres



Prepared by JAMES HULL MILLER
Theatre Designer

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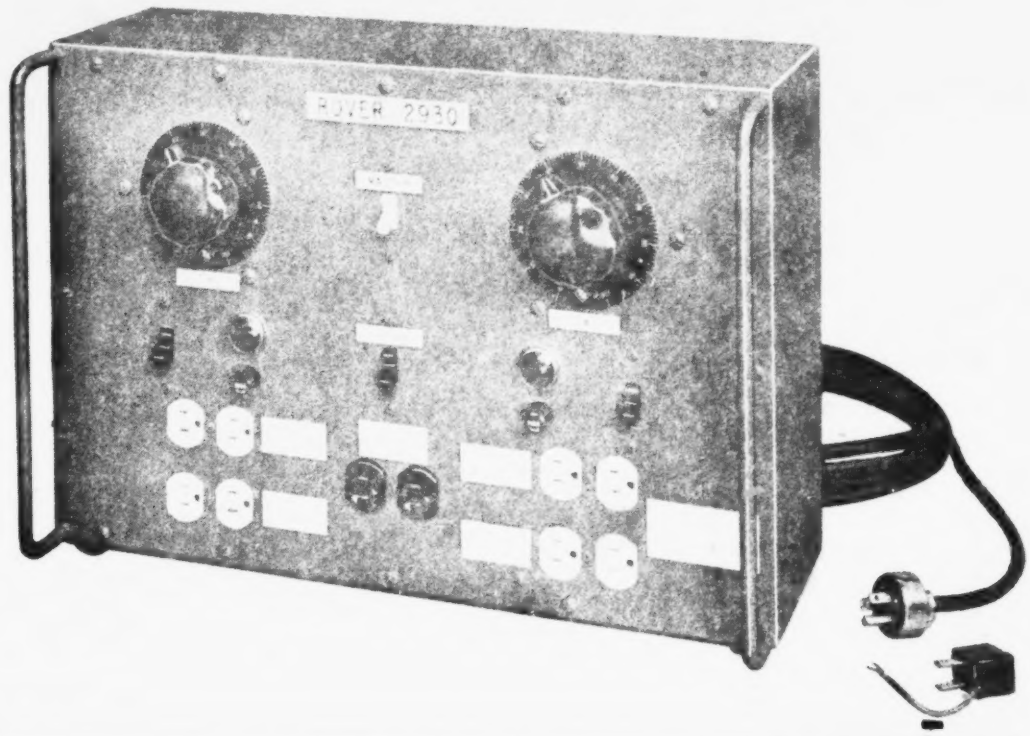
Complete Kits and Instructions for the Smaller Stage

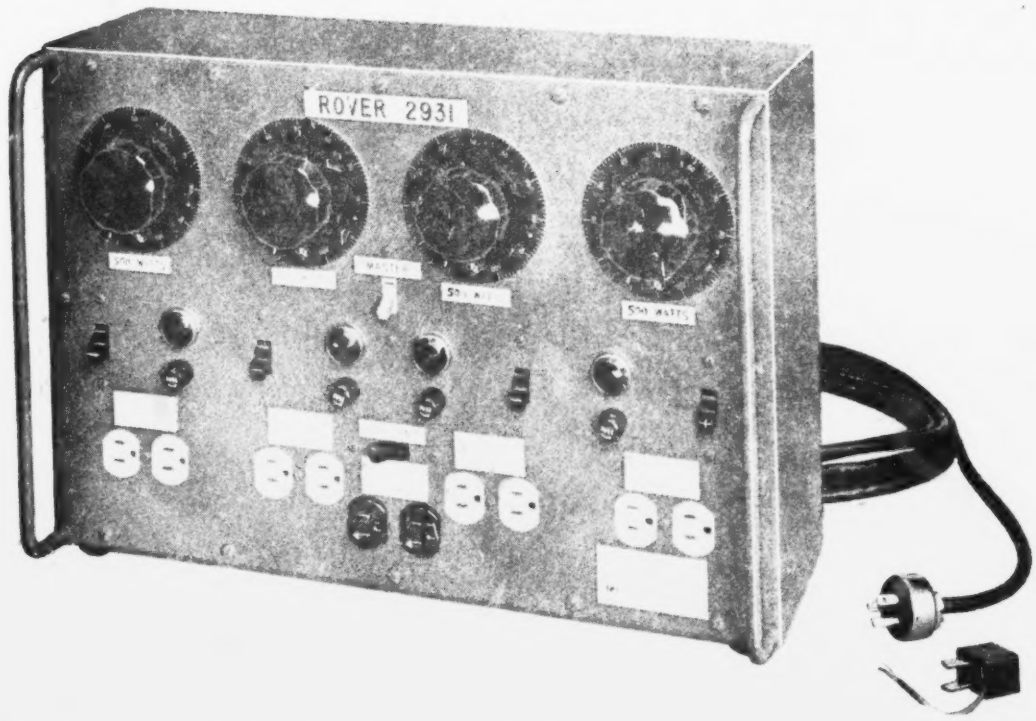
Children's theatre is one of the most progressive theatre movements in the country today. Its power lies largely in its manifold, decentralized activities and grass roots organization. Obviously a technical support designed especially for simplicity and economy is necessary, but all too often absent.

In this bulletin, HUB not only presents several lighting systems appropriate in size and cost for smaller stages, but completes its analysis with production notes explaining in detail lighting, projection and design techniques which make the most of the simple HUB systems for stage illumination for all small dramatic groups at home and on tour.

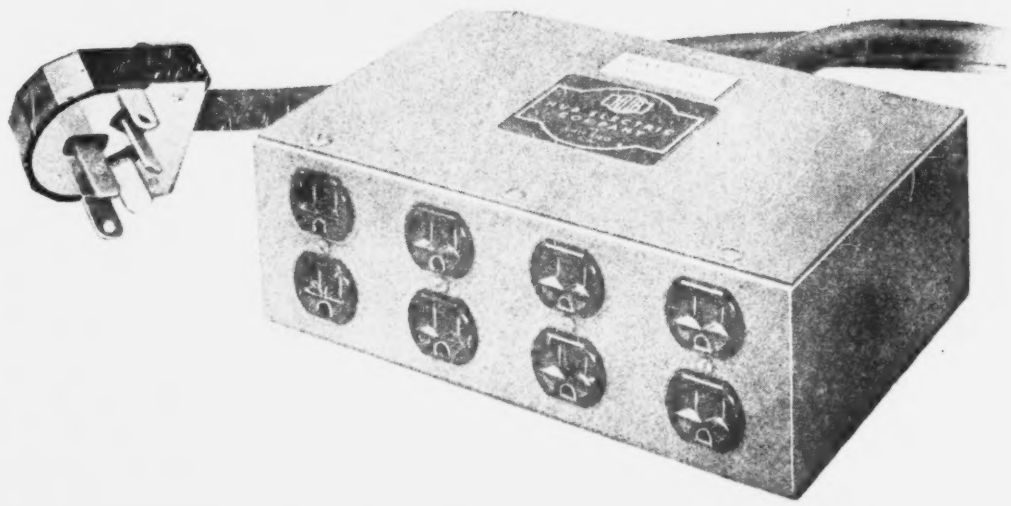
File in Hub Electric Company's 3-Ring "SPECIFICATION" Binder



Hub No. 2930
Portable Dimmer Switchboard



Hub No. 2931
Portable Dimmer Switchboard



Hub No. 11320 Main Feed Box
for the Double Rover System

THE "SINGLE ROVER" SYSTEM

(Hub #104R)

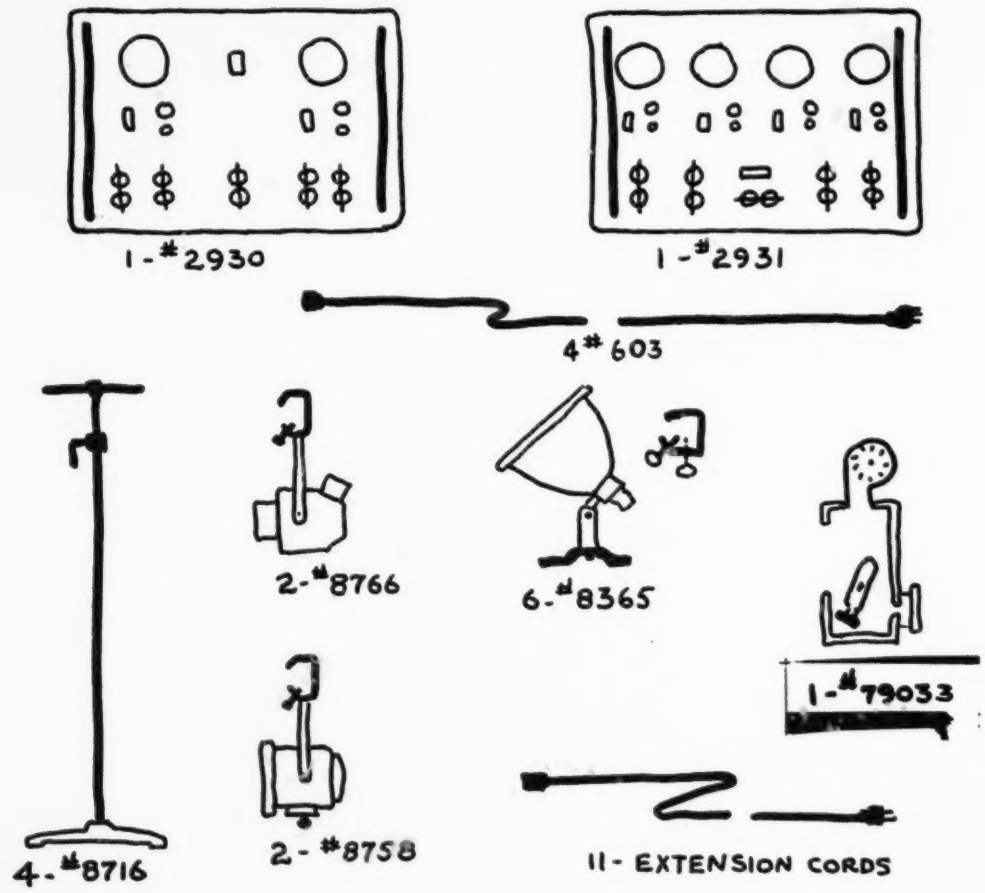


ILLUSTRATION II

DESCRIPTION AND INSTRUCTIONS

1–Hub #2930, Portable Dimmer Switchboard consists of two 1000 watt auto-transformer type dimmers with knob control handles, a standard duplex receptacle for undimmed utility circuits, two flush grounded twistlock input receptacles and a master switch. Each dimmer is provided with a pilot light, a fuse protection, a control switch and four output receptacles for standard or polarized grounded plugs for stage circuits. The totally enclosed metal case is 14" high x 21" wide x 6" deep with vent grills and combination guard rods and carrying handles on face, and finished baked gray-green wrinkle.

1–Hub #2931, Portable Dimmer Switchboard is similar to above except having four 500 watt dimmers, with two output receptacles per dimmer instead of four.

4–Hub #603, Feeder Cable is 25 ft. long 3 conductor with female twistlock connector at one end and standard plug with ground at other end.

2–Hub #8766, 500 watt, 4½ in. lens, wide-beam ellipsoidal spotlight, yoke, C-clamp, color frame, standard plug. (Recommended lamp, 500 watt T/12/9, medium prefocus base).

2–Hub #8758, 500 watt, 6 in. fresnel lens spotlight, yoke, C-clamp, color frame, standard plug. (Recommended lamp, 500 watt T/20/64, medium prefocus base).

6–Hub #8365, 200 watt adjustable floodlight, yoke, color frame, base for surface mounting, C-clamp for mounting on pipe or edge of board, standard plug. (Recommended lamp, 200 watt PS inside frosted, medium screw base).

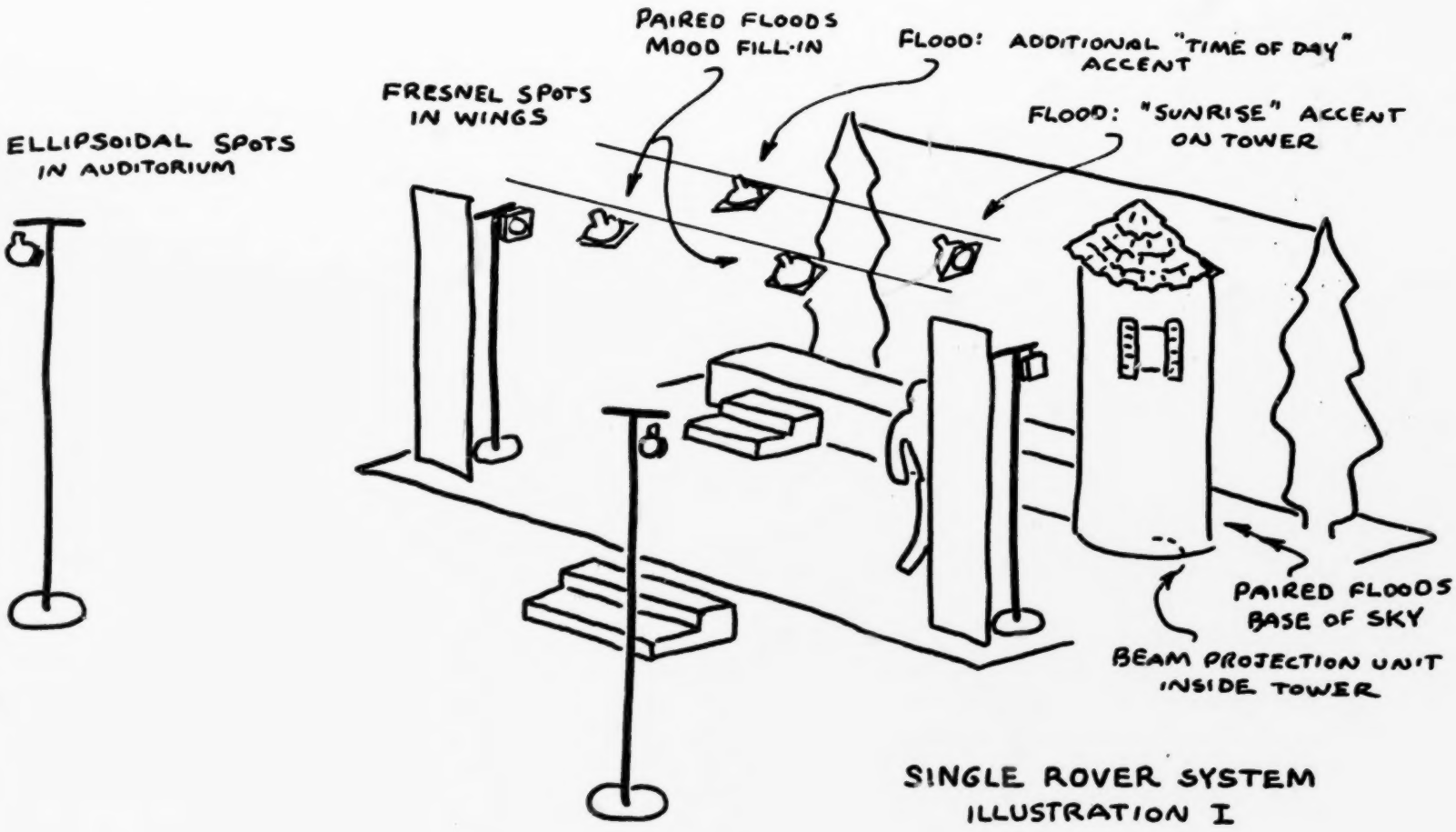
1–Hub #79033, 500 watt Beam Projection Unit for floor use, with silent blower, adjustable gate and standard plug. Recommended lamp, ONLY, GE Projection PH/500T/10 P, C-13D, medium prefocus base. Hub furnishes initial lamp on this item.

4–Hub #8716, Telescoping floor stand, 18 in. heavy base, vertical pipe tree with 12 in. branch arms at top, adjustable from 6 to 11 feet in height.

11–Extension cords #16 2-wire SJ type stage cables, each with standard plug on one end and female connector for standard plug on the other end, in lengths as follows: 1 – 60 ft., 3 – 50 ft., 3 – 40 ft., 2 – 35 ft., and 2 – 25 ft.

The ROVER system plays a unique role on the American theatre scene. It is designed for small stages, or where the playing area must be reduced to twenty feet or thereabouts for touring. It is entirely portable: even the control unit is divided into two compact boards for easy movement and is made *completely safe electrically.* The surface-mounted switches and knobs are protected by two guard rails. These rods serve as carrying handles. Also, where the Rover units are stacked, the extension cables can be tied to these rods, thus keeping the face of the board free. Each switchboard has its own feeder cables. These cables, terminating in standard plugs, may be connected to any duplex convenience receptacles on a circuit fused for 20 amps. Thus, only two duplex receptacles are required for the Rover system, each being on a separate circuit at the fuse or circuit breaker panel. It is difficult to find an assembly area where this cannot be done. Where footlights or borderlights are wired in, two circuits of lamps can be unscrewed and the circuits freed for the feeder cables, since the Rover system replaces this type of illumination.

Illustration I shows the Rover system set up on a small but typical stage. While this system can deliver only 4000 watts of illumination, this illumination is distributed and controlled in such a manner that we gain complete control of the stage environment, and can handle simple night-to-dawn-to-day transitions, magic castle dissolves, and a fair amount of highlighting. (Cf. the Production Notes to the rear for technical descriptions of such effects with the Rover system.) A special Hub feature is the dual-purpose clamp that is interchangeable with the floor mount on the adjustable floodlights. The set screw can be repositioned in the clamp for gripping either a pipe or the edge of a board. This makes it possible to attach the flood in many places, including the treads of a step-ladder, structural angle iron, wooden battens to which borders are tacked, etc.


PAIRED FLOODS
MOOD FILL-IN
FLOOD: ADDITIONAL "TIME OF DAY" ACCENT
FRESNEL SPOTS IN WINGS
FLOOD: "SUNRISE" ACCENT ON TOWER
ELLIPSOIDAL SPOTS IN AUDITORIUM
PAIRED FLOODS BASE OF SKY
BEAM PROJECTION UNIT INSIDE TOWER

SINGLE ROVER SYSTEM
ILLUSTRATION I

The DOUBLE ROVER System (Hub #104DR)

The DOUBLE ROVER System ADDS the following equipment TO the initial SINGLE ROVER System:

1–Hub #2930, Portable Dimmer Switchboard as described before

1–Hub #2931, Portable Dimmer Switchboard as described before

4–Hub #603, 25 ft feed cables as described before

1–Hub #11320, Main Feed Box with #8 3-wire cable 6 ft. long and 50 amp. range plug. Box contains four standard duplex receptacle with ground for #603 feed cables to Rover Switchboards, associated fuses, cable strain relief

6–Hub #8365, 200 watt adjustable floodlights, as described before

2–Hub #8766, 500 watt ellipsoidal spotlights, as described before

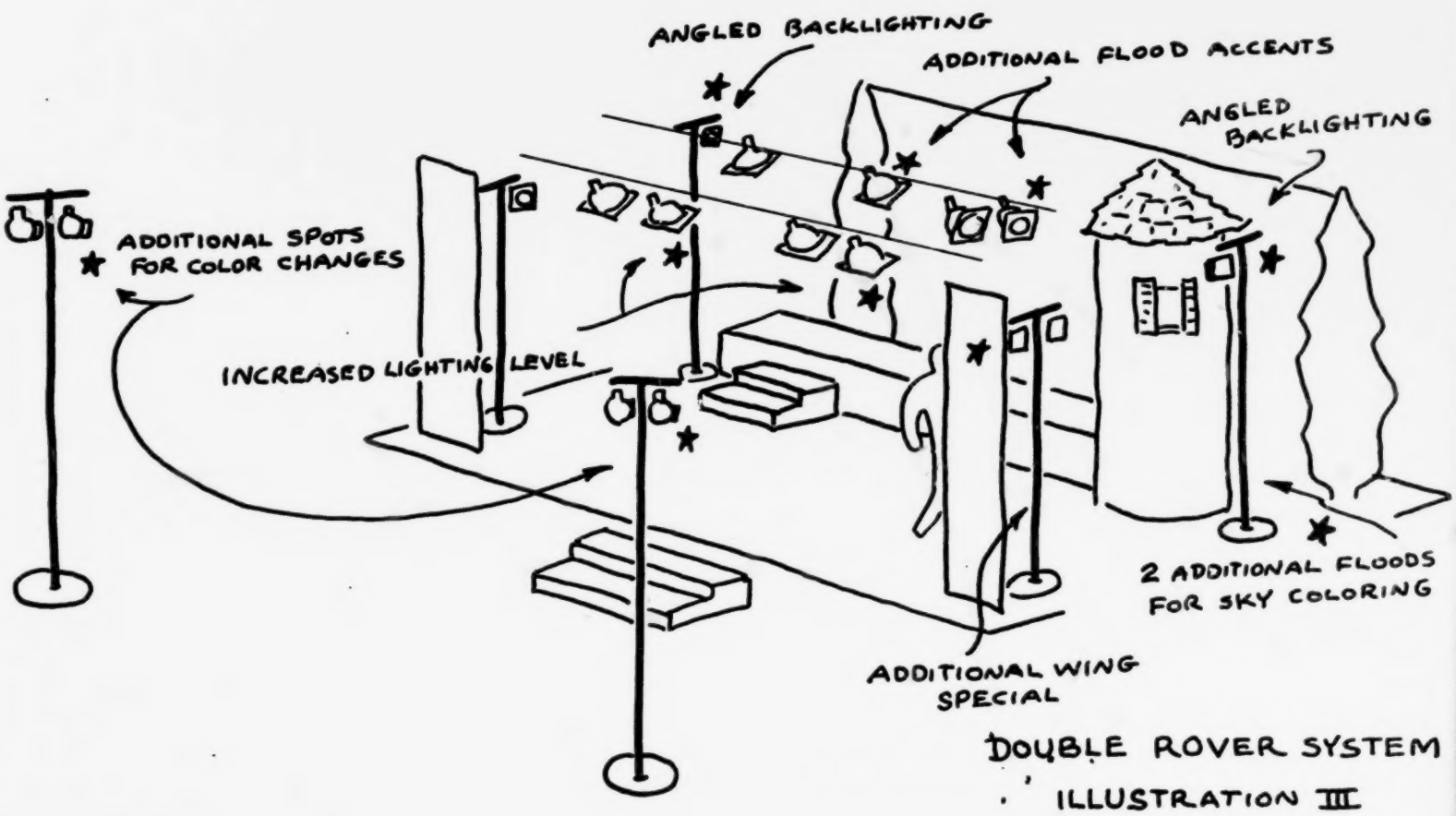
3–Hub #8758, 500 watt fresnel spotlights, as described before

2–Hub #8716, Telescoping floor stands, as described before

11–Extension Cords. #16 2 wire stage cables, as described before.

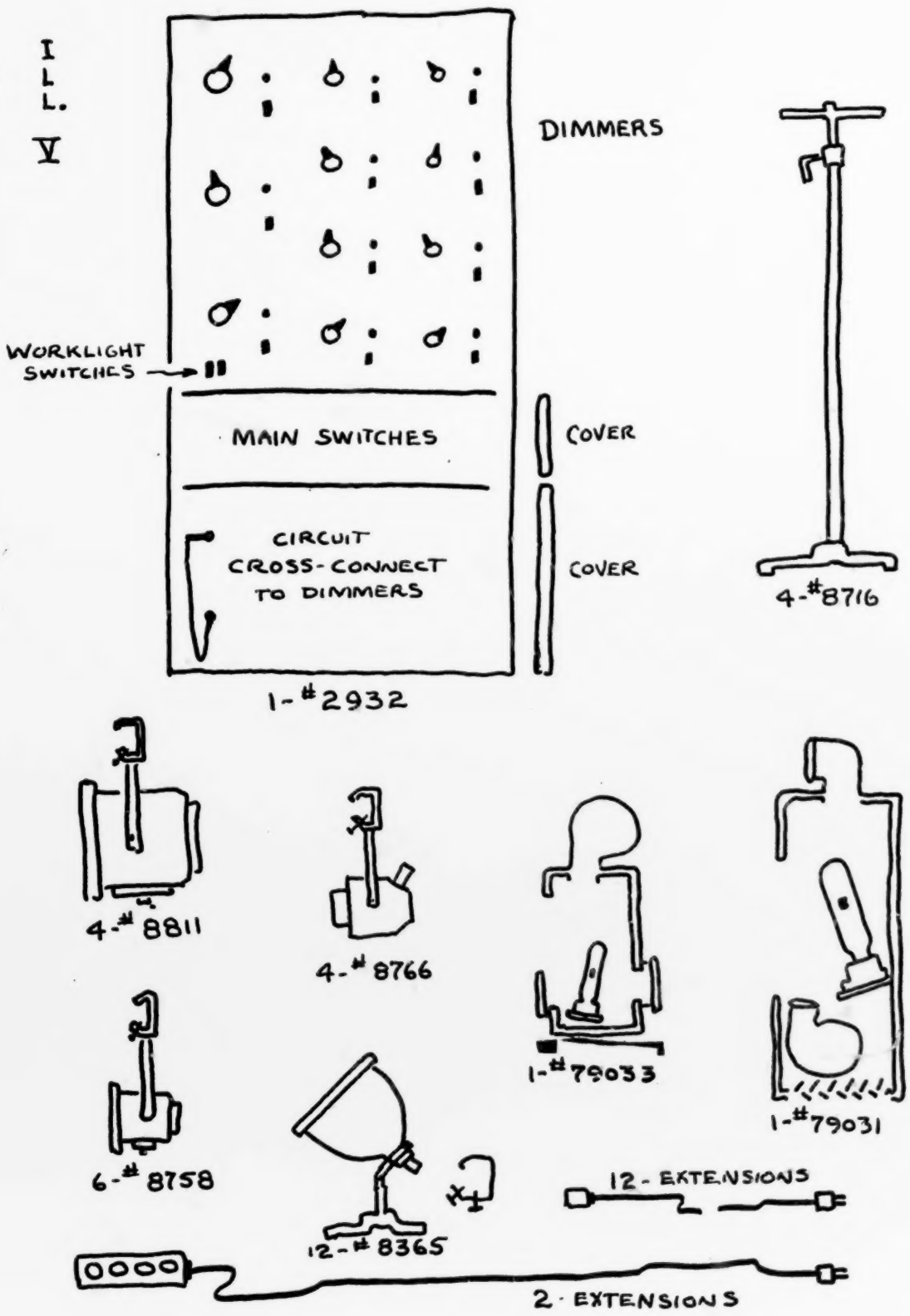
NOTE: for those purchasing the DOUBLE ROVER System at the outset, it is necessary to combine these items with the items listed under the SINGLE ROVER System.

The DOUBLE ROVER System increases the flexibility of the original SINGLE ROVER System by 100%. It makes possible operation on slightly larger areas. Yet portability has not been sacrificed. All ROVER light control units are made to stack side by side and top to bottom. Each unit will have its own feeder cable and can be used elsewhere at any time. The chief difference between the SINGLE ROVER and the DOUBLE ROVER Systems is the addition of a main feed box assembly, and the need for the installation of a 50 amp. range receptacle on the stages where it is planned to use all four portable dimmer switchboards. This will not prevent using, or loaning out, part or even all of the boards without the mainfeed box assembly, depending, of course, on the number of separate 20-amp circuits available for individual feed cables. Illustration III shows how the additional equipment of the DOUBLE ROVER System (indicated by stars) is distributed to increase (1) color changes for toning, (2) the level of illumination and (3) highlights and specials.



DOUBLE ROVER SYSTEM
ILLUSTRATION III

The "INSTALLATION" Sytem (Hub #104-IN)



AND INSTRUCTIONS

1 – HUB #2932 Control Board and Interconnection Panel, approximately 33 inches wide by 63 inches high by 8 inches deep, vented flush face, for permanent building installation, consisting of main switch and fuses to input, 4 sub-main switches, (3) 2000 watt, (4) 1000 watt and (4) 500 watt radial type auto-transformer dimmers, with associated pilot lights, switches and fusings, 3 transfer switches to employ 2000 watt dimmers for non-theatrical concert illumination when desired, stage work light switches, all with associated breakers; dimmer output and cross-connect panel with 4 jack receptacles per 2000 watt, 3 receptacles per 1000 watt, 2 receptacles per 500 watt dimmers, and 2 receptacles per non-dim circuits, 36 outgoing circuits via safety patch type cords, test jack receptacle and load meter, 2 metal locking covers, one for cross-connect panel, the other for main switch bank.

2–Hub #8811-OB, 1000 watt, 8 in. fresnel lens spotlight, oval beam type, yoke, C-clamp, color frame and connector*. (Recommended lamp, 1M/G40, mogul prefocus base.)

2–Hub #8811, 1000 watt, 8 in. fresnel lens spotlight, round beam type, otherwise as above.

6–Hub #8758, 500 watt, 6 in. fresnel lens spotlight, round beam type, yoke, C-clamp, color frame and connector*. (Recommended lamp, 500/T20/64, medium prefocus base.)

4–Hub #8766, 500 watt, 4½ in. wide-beam lens ellipsoidal spotlight, yoke, C-clamp, color frame and connector*. (Recommended lamp, 500/T12/9, medium prefocus base.)

12–Hub #8365, 200 watt adjustable floodlight, yoke, color frame, base for surface mounting, C-clamp for mounting on pipe or edge of board, and connector*. (Recommended lamp, 200 watt PS inside frosted, medium screw base.)

1–Hub #79031, 1000 watt Beam Projection Unit for overhead use, mounting studs, silent blower, adjustable gate, connector*. Recommended lamp, ONLY, GE PH 1 M T/20/40 C-13D, mogul prefocus base. Hub furnishes initial lamp on this item.

1–Hub #79033, 500 watt Beam Projection Unit for floor use, silent blower, adjustable gate, connector*. Recommended lamp, ONLY, GE Projection PH/500T/10 P, C-13D, medium prefocus base. Hub furnishes initial lamp on this item.

4–Hub #8716 Telescoping floor stand, 18 in. heavy base, vertical pipe tree with 12 in. branch arms at top, adjusting from 6 to 11 feet in height.

12–30 ft., #14, rubber covered stage cable, complete with connectors*.

2–50 ft., #14, rubber covered stage cable, as above, except with 2 female receptacles in metal box at one end.

*Choice of connector by client. However, if the INSTALLATION SYSTEM and ROVER SYSTEM equipment is to be interchangeable, one type of connector system should be maintained throughout.

This particular controlboard is designed to be installed permanently in the smaller type of institutional theatre-assembly chambers, as found in churches, YMCAs and YWCAs, civic recreation buildings, elementary schools and small community theatres. It is designed for the control of theatrical and concert lighting and stage work lights.

Because it is difficult to anticipate load requirements for general auditorium lighting and because such illumination should be controlled remotely from several vantage points such as backstage, lobby and often additional entrances, we recommend a separate motor-driven control system with raise-lower switches for the auditorium lighting. Therefore, this phase of control is not included in the #2932 INSTALLATION unit.

It is indeed difficult to determine the correct lighting system even for a stage of a designated size, for the skill of a lighting operator plays an important role. It is well known that the more flexible the lighting is, the less the overall power requirements are. By flexibility, I do not mean the ganging up on several circuits a miscellany of lighting instruments located along fixed batten strips, but rather the ability to place instruments almost at will, to be controlled individually or in small groups. With this type of operation in mind, and excluding "house lights," the Hub INSTALLATION board and associated lighting equipment will handle a stage up to 25 feet in playing width, with a 10½ foot mounting height. Beyond this area, we recommend a standard theatrical lighting installation, such as is described in our Catalog #109, "Engineered Lighting and Control Equipment for Open Stage Theatres," and in other HUB publications.

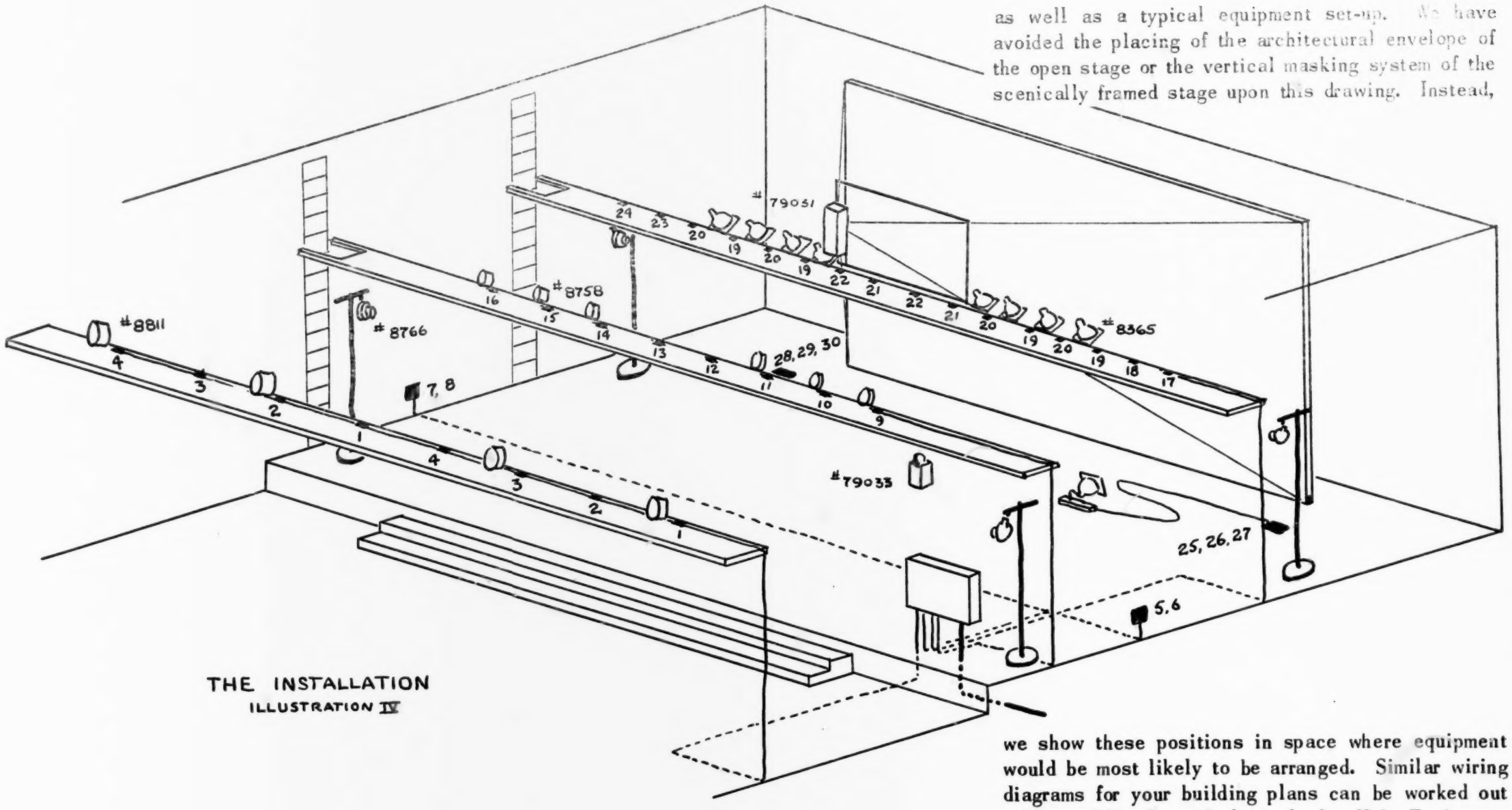
Economy, both in space and cost, flexibility, and a high degree of individual control are represented in the INSTALLATION. The inexpensive radial type of auto-transformer dimmer is used throughout, making it possible to obtain a board depth of only 8 inches, an important factor in mounting where space is restricted, especially in remodellings. The radial control movement is a smooth one for stage lighting.

Since it does not lend itself as readily as does lever control to mass manipulation, sub-master switches are included, grouping certain dimmers electrically for partial blackouts, etc. These sub-master switches are identified with the related dimmers by a system of separate pilot light colors.

There are two protective metal covers which can be locked over the lower face of the board, one cover to secure the inter-connecting panel from being tampered with, the other, of less importance, to protect the bank of main switches. With the lower cover locked in place, the danger of indiscriminate overloading of the dimmers is prevented when non-technical personnel are using the board. By a certain arrangement of the main and transfer switches, a major part of the board can be disconnected and a limited amount of lighting prearranged, and the locking on of the second cover protects this arrangement. There is one additional protective device, the load-meter, into which the circuit jacks can be inserted to double-check the wattage that has been connected to a circuit. This prevents mistakes of overloading the dimmers, however unintentional.

Illustration IV, a true-proportion isometric, shows the approximate location of 30 of the outgoing circuits

as well as a typical equipment set-up. We have avoided the placing of the architectural envelope of the open stage or the vertical masking system of the scenically framed stage upon this drawing. Instead,



THE INSTALLATION
ILLUSTRATION IV

we show these positions in space where equipment would be most likely to be arranged. Similar wiring diagrams for your building plans can be worked out without difficulty; if desired, by Hub Engineers. In addition to increased power and flexibility over the DOUBLE ROVER System, a new piece of equipment is introduced, the 1000 watt Beam Projection Unit, designed for overhead background projection. The technical details for the location of this unit are covered in Experiment #4 in the section on Production Notes. Also, HUB Catalog #109, as mentioned above, has additional information on the subject of background projection.

All branch circuits must be two-wire No. 12 service:

120/240 Volt Single Phase, 3 wire, 70 Amp.,

or, 120/208 Volt Three Phase, 4 wire, 50 Amp.

(SPECIFY)

PRODUCTION NOTES

Section A; Lighting the Actor
Section B: Four Detailed Experiments with Light on Backgrounds
Section C: Miscellaneous Design and Techniques Involving Illumination.

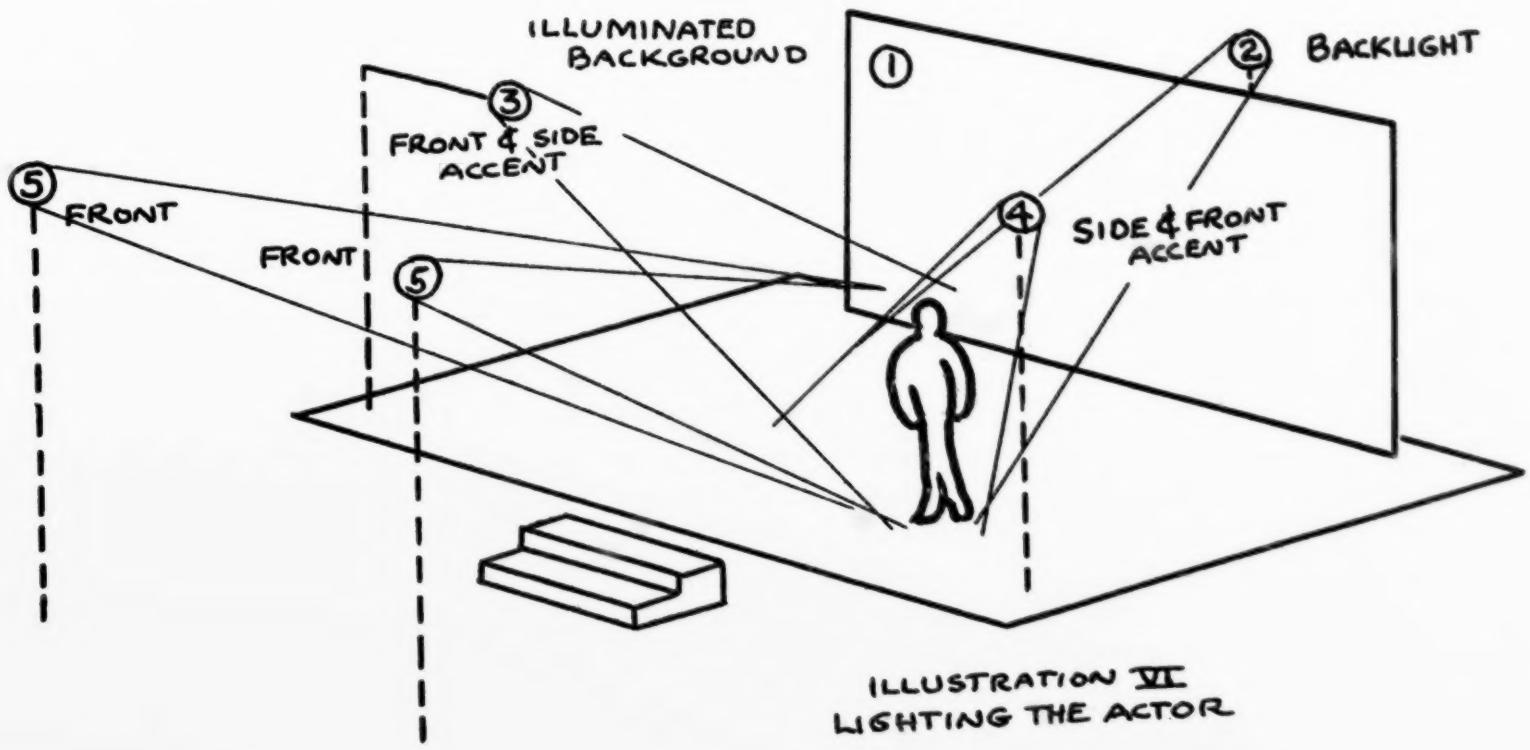


ILLUSTRATION VI
LIGHTING THE ACTOR

Section A: LIGHTING THE ACTOR

The *first* thing in the lighting of the actor is to establish the proper separation between actor and scenery. If the background is illuminated separately by hidden floods or consists of translucent panels, the identity of the actor is rendered in silhouette.

The *second* step is to establish a sculptural quality to the actor in such a way as to give him an existence of his own in a three-dimensional space. This is accomplished by backlighting, preferably by an oblique path of light from overhead to the rear of the stage.

A *third* source should consist of a path of light from a front and side position, preferably located overhead along the forward edge of the playing area. If forward elements of the set are of textured material, this spotlight will add much scenic mood as well. For changes of mood, this would be the light to duplicate in another color.

Ideally, the *fourth* source of light should come from the opposite direction, also a strong oblique frontal, but if lights are limited, this would be the one to do without.

Fifth and last, but not least, a good direct frontal field of light is required, preferably soft, such as from paired oval beam fresnel spotlights, set at an angle of approximately 45° up and beyond the acting area. In some theatre designs, these would be called the auditorium spotlights.

Generally speaking, the intensity of the various spotlights would be in the same order as described here, with the backlighting most intense, the front lighting the least intense. Remove the proper angle lighting backstage and upstage and you will lack clarity regardless of how intense the front lighting becomes.

By referring to the SINGLE ROVER System, Illustration I, you will notice that we have employed two spotlights on stands to the sides of the auditorium. This is not as ideal as a strong overhead position but it is far better than footlights. Since this position will vary, we have recommended the ellipsoidal spotlight for its efficient masking shutters. though its harsher light is more suitable for wing accent, as shown in Illustration IV. Immediately backstage, behind screens or in the proscenium wings, depending on the nature of the theatre, we can

obtain very good accent lighting positions. After this, we must depend on the adroit positioning of the small flood lights. A great deal can be accomplished with them on the small stage.

With the DOUBLE ROVER System, Illustration III, we pick up additional spotlights for the auditorium positions, giving us a more complete day-to-night control, and two more spotlights on tall stands for backstage use. These latter would best be placed in additional wing positions, preferably towards the rear of the stage. And now we have the beginning of obliquely angled backlight. Together with the additional floodlights, we possess a very fine lighting system for the small stage. You will note that a separate cord is supplied for each instrument, making the possibilities of location endless.

With the INSTALLATION System, a number of key positions for lighting are to be incorporated in the theatre building itself, such as strong frontal positions for the auditorium spots, preferably oval-beam fresnels, wide pipe battens or onstage cat-walk slots for spots, and preferably a backlighting position over the entire width of the sky piece where some of the wide-beam ellipsoidals will work very nicely. Illustration IV shows some of these positions, though the drawing has been simplified for the sake of clarity.

Section B: Four Detailed Experiments with LIGHT on BACKGROUNDS.

Experiment #1. (Background Materials)

(A) Hang or otherwise support a large piece of #230 Water Green or #232 Aqua Indian Head Cloth. Place two or more of the #8365 Floodlights about two or three feet back from the cloth on the floor and color with Cinemoid #15 (Peacock Blue) plastic color medium. This method will serve for most conventional "sky" backgrounds. Further details on this will be found under Experiment #2.

(B) Substitute burlap cloth. Study the effect of the rougher texture. Move the floods closer and note possibilities of texture from a more sharply angled source of light. Substitute darker burlap, such as charcoal gray, and arrange for shadows of objects to "spill" on background. Compare this to "spill" on the Indian Head surface. Change the color medium to Cinemoid #32 (Medium Blue). Note how the quality of the darker texture responds.

Conclusions: (1) dyed material makes excellent backdrops. (2) Textured materials are better where light source is very close. (3) Darker, extreme textures are essential where stage is so small that distracting shadows will fall across these general backgrounds. (4) Darker backgrounds require more saturated colors, not pastels or blends.

Experiment #2. (Projected Images, Negative)

(A) Mount a tinted backcloth such as Aqua or Water Green Indian Head. Illuminate with partially dimmed floods.

(B) Place Hub #79033, 500 watt Beam Projection Unit about 6 feet away from backcloth. Cut an image, such as a castle silhouette, from a large sheet of heavy wrapping paper. Discard image, retain sheet of paper. Mount sheet of paper in frame and set 2 feet away from Beam Projection Unit. Dim up Beam Projection Unit and observe how the castle illumination replaces the color tint on that portion of the backcloth.

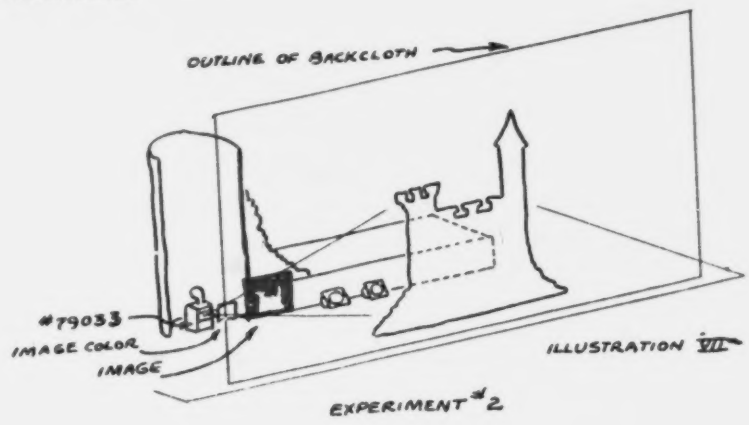
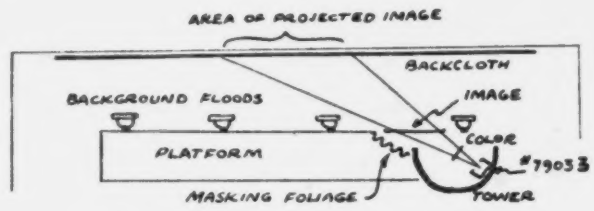


ILLUSTRATION VII

EXPERIMENT #2



PLAN for EXPERIMENT #2

ILLUSTRATION VIII

(C) On a smaller frame, mount gelatine color and set near gate of Beam Projection Unit (allowing for ventilation), thus coloring the entire castle area.

Conclusions: (1) you can develop a background by (a) tinted surface, (b) added tinted illumination, and (c) added image in colored light in specific area. (2) You have developed the means whereby you can handle dissolves such as Aladdin's palace appearing out of thin air. (3) You can change or correct background by interplay of three separate elements, general color, image color, and the nature of the image shape itself.

Note on Application: Illustrations VII and VIII show platform which forms masking for floor-based floodlights and tower which forms a mask for the #79033 Beam Projection Unit. Angle of projection does not matter so long as wrapping paper image plane is kept parallel to backdrop. Obviously the placing of an image in light on a generally lit backdrop is simpler than attempting the *total* area of the backdrop with the Beam Projection Unit alone, a technique covered in Experiment #4. In this method, since the image is bright and falls on a darker background, I use the term "negative image."

Experiment #3 (Translucent Panels).

(A) For translucent panels you need a fine cotton fabric such as Bates "Disciplined," ivory tint. Unbleached muslin or sheeting are definitely unsuitable, while synthetics such as nylon, etc. do not stand up well under tension and are also affected by humidity. Professionally, an expensive seamless plastic screen is used, although I prefer the mat surface of the fine cotton fabric.

(B) For successful translucent projection, I recommend a series of panels rather than one wide expanse. For one thing, the wider a single translucency the further you must move the projection apparatus away and the more powerful the lamp must be. With a wide series of panels, it is always possible to use a second Beam Projection Unit. Also, the smaller panel can be inserted more easily into that part of the acting area where direct frontal light is not too strong.

A series of panels *also* lend themselves to architectural arrangements not in a straight line. This provides (1) self-support, (2) better masking of images, the Beam Projection Unit and/or floods (Illustration IX), and (3) freedom to design more arbitrary and economical shapes.

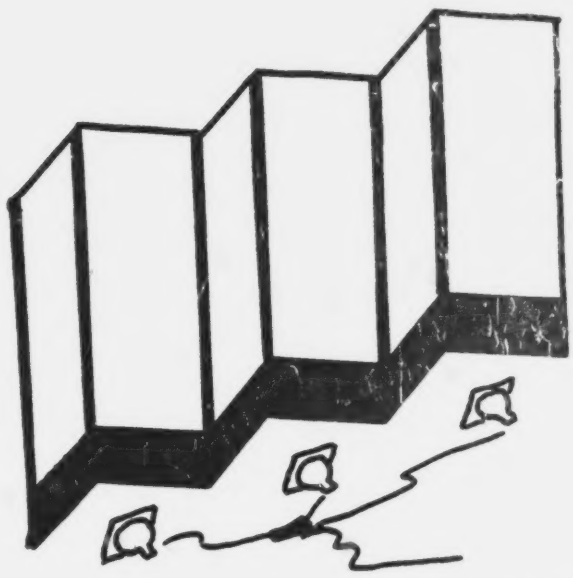


ILLUSTRATION IX

(C) Illustration X shows an arrangement of the Beam Projection Unit 6 feet from a series of panels for a Japanese scene. 30 inches from the Projection Unit is placed a frame containing a large piece of hardware cloth, with 1/8 inch mesh. A disc has been cut out and profile limbs and leaves appliqued. The effect will be dark foliage, gray sky and white moon. You will note that from a distance the mesh pattern does not resolve itself as such to the eye. While the applique to the mesh may be wrapping paper, the foliage over the moon area must be of cardboard or stronger material and any necessary vertical support-

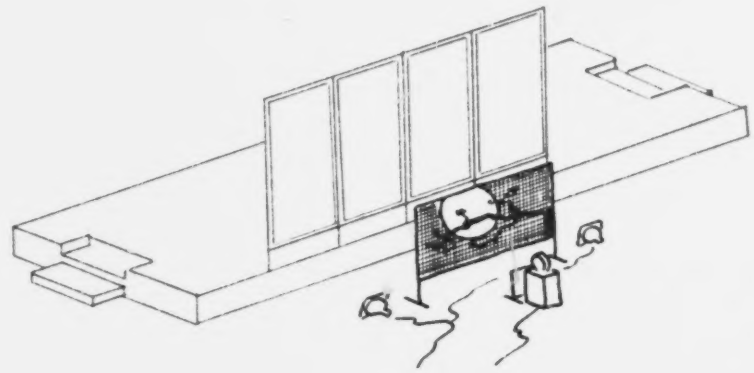


ILLUSTRATION X

ing wires may be masked by a screen panel member.

(D) Illustration X shows further the presence of a color medium near the gate of the Beam Projection Unit, and also several floodlights on the floor, by the image. The latter are for the coloring of the shadow area, the former for the coloring of the sky and moon areas.

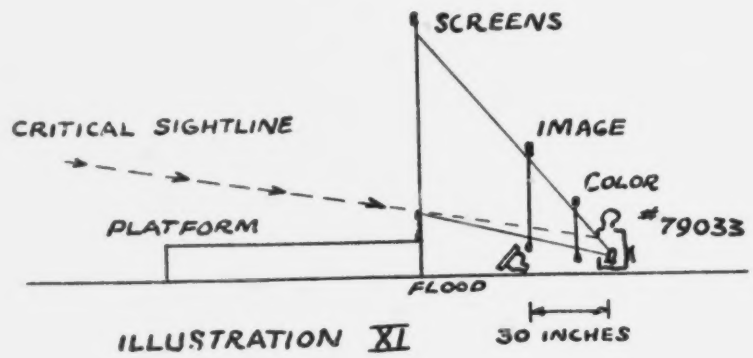


ILLUSTRATION XI

(E) Illustration XI shows a cross-section and the relationship of the various parts in elevation are noted. Unless a plastic screen is used for translucencies, the *filament* (only, not the image) should lie below the spectator's eye level, hence the necessity to build up masking by platforms and/or opaque panels at the base of the screens. The mat quality and the economy of the fine cotton fabrics such as the Bates more than compensates for this additional design factor.

Experiment #4 (Overhead Background Projection)

(A) This is the first method of projection mentioned which lends itself to overall background coverage on a single, unbroken surface. It is also the most difficult unless a theatre has been properly arranged for its use, at which time it becomes the simplest method. The two basic requirements are to bring an image down onto the background at no greater than a 50° angle to the base, and to maintain a distance of no less than 3 feet 6 inches from the special filament of the PH 1M/T20/40 C-13D Projection Lamp of the #79031, 1000 watt. Beam Projection Unit.

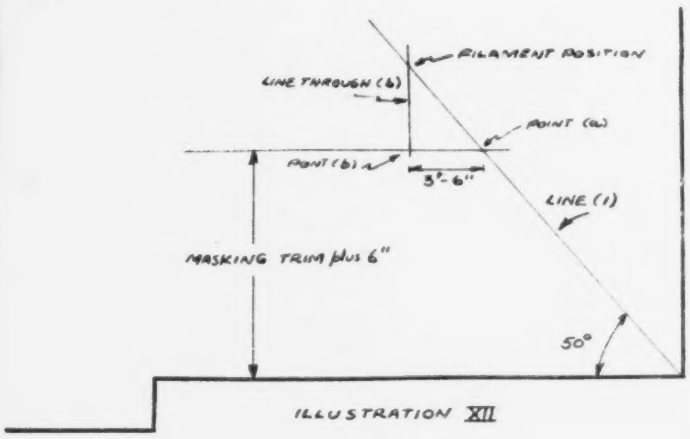


ILLUSTRATION XII

(B) First, by cross-section, from the base of the backdrop, draw a line (1) downstage and upwards at an angle of 50° to the floor. Next, to scale, draw a horizontal line representing the height of your desired overhead masking plus 6 inches. In this instance I will use a 10 foot 6 inch masking trim height, so this horizontal line will be 11 feet above the stage floor. A similar relationship occurs in Illustration IV. Mark the intersection of this line with line (1) as point (a). Downstage from point (a) measure 3 feet 6 inches along this horizontal line, and mark this distance with point (b). Through point (b) draw a vertical line. Where this vertical line intersects with line (1), establish the filament position for the 1000 watt Beam Projection Unit.

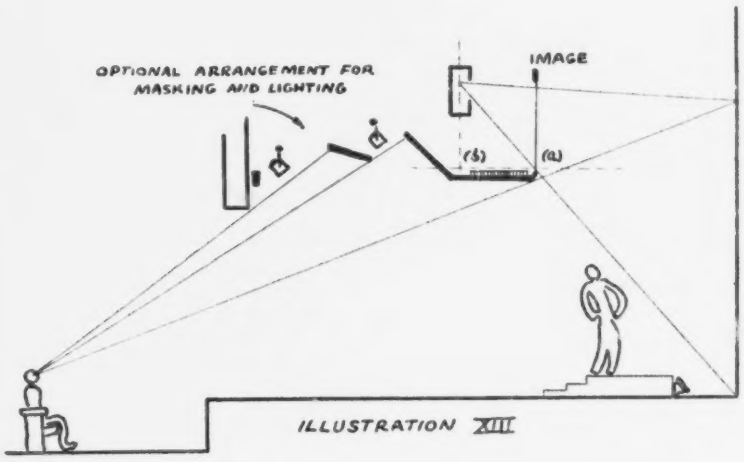


ILLUSTRATION XIII

Now refer to Illustration XIII. From the filament point, extend a line to the top of the desired image projection on the backdrop, or at least draw the highest line possible that will clear any necessary upstage masking. Ideally, though, there should be no masking upstage of the projection unit, so that the nearest audience members see directly to the top of the projected image, rather than over it.

A vertical line extending from point (a) and intersecting with the line from the filament to the top of the backdrop represents the image plane. Establish the horizontal mask, a line about 4 feet long and 6 inches below line (a-b). In a specially designed theatre, this line also represents the catwalk. A diagonal line connecting to this mask and angled upwards and downstage to intersect with the critical sightline from the audience completes the masking for the Beam Projection Unit and its image. Obviously, on different stages, the formula given here, not the particular example, should be followed. In many instances, it will be impossible to establish the proper position and arrangements without considerable alterations to the existing masking systems.

(C) Notes: Selection of the correct filament (about ½ in. square for the recommended 1000 watt lamp) and the correct filament-to-image distance (in this case 3 feet 6 inches) make the difference between this fine system of projection and the more crude effect often known by the name of Linnebach. Separation of the lamphouse from the image area eliminates two other bugaboos of Linnebach, distortion and the difficulty of securing heat-resistance images. Note that the image is vertical. The fact that this places the image in a plane parallel with that of the background explains the absence of any distortion. Since the image is several feet from the lamphouse, all sorts of economical materials can be used, chief among these heavy wrapping paper for cut-outs.

There are two reasons why this type of projection system cannot be masked by vertical cloth borders. Since the border which will mask the bottom of the image will have to be placed downstage of the lamphouse, its trim will be much lower than that of the horizontal mask just below line (a-b). Also, there is considerable reflection from the face of the image, especially where gelatine colors are applied to cut-outs, and this reflection bounces onto the floor downstage and otherwise interferes with the lighting. Reference to Hub Catalog No. 109, "Engineered Lighting and Control Equipment for Open Stage Theatres," will show how a theatre is properly designed for the use of projections and optimum background illumination.

There is a triangular area upstage where no high set pieces may be placed without shadowing their profile onto the background. This is true of any projection system, but a little care in design will reduce this to a minimum. The position of the mask at approximately 50° has another positive factor, however, for a few scoops can do a better job of general background illumination than any continuous row of borderlights located closer to the background. For the small stage I have used as an example four 200 watt floodlights, per circuit (cf. Illustration IV). To this should be added some amount of horizon glow from below.

Section C: Miscellaneous Designs and Techniques Involving Light

INTRODUCTION.

Whether or not a capacity for illumination is adequate depends a great deal on the nature of the scenery employed. Some settings, especially those painted with a great amount of detail, require rather staggering amounts of light for visibility. This, in turn, creates the need for even stronger highlights in order to separate the actors from the background. When a stage has but a modest supply of electrical current and equipment, it is wise to employ backgrounds which are fashioned in textured materials, of sculptural shapes, and which contain, where possible, some elements of internal lighting, such as translucent panels, windows, lanterns, or those which use projected imagery.

Image Making for the Beam Projection Units.

There are two principal approaches to the making of an image. You may prepare a silhouette of the key features of the design either in terms of illumination or opacity. For example, take a castle on a hilltop against the horizon. You may cut a castle and hilltop profile from a large piece of card or wall board and place this in the image plane. Coloring the projection beam with a blue gelatin near the lamphouse will take care of the sky.

Or, you may light the sky with floods. Then, from a large piece of wrapping paper mounted on a frame, cut out the castle and hilltop. Cf. Illustration VII. Tape green gelatin over the hilltop area of the image, and perhaps yellow over the castle area. If the floods are not too bright, the colored images of hilltop and castle will wash out the general color of the background and replace it with their own. If the floods are too bright you will obtain a color blend instead.

The second method has several advantages, aside from the obvious magic of image dissolves. One, by not having to include in the image plane the overall background, many more varieties of gelatin mosaics may be fashioned, a sheet of colored gelatin being only 20 by 24 inches in area. While it is possible to join gelatins by halved strips of transparent "Scotch" tape, this technique should be used only where a change of color occurs. Another advantage is, by not having to "reach" for the entire background with one projection lamp filament, images may be smaller and the overall field of illumination, by floodlights, more even. Still another advantage is, by increasing the number of separately controlled elements of an image, such as overall color, color of image, and shape of image, we increase the ability to experiment and reach more significant values than originally intended.

There is yet a third way to compose an image, and this is by way of painting (or staining, as it were) the entire image, both opaque detail, colored detail and background color, on a sheet of acetate or clear plastic with either lamp dip or transparent lacquer dye colors. There are several disadvantages. A good sheet of acetate of the necessary size will cost upwards of $4. Transparent lamp dips and lacquer dyes (artist's brushing lacquer) are limited in colors and do not blend well for in-between colors. On the other hand, the colors available in all the theatrical gelatins and plastics number well over a hundred. Brush strokes can be seen, therefore the technique of application must be artistically consistent. Finally, the image is "frozen" in that all parts are represented on one finished sheet, whereas with the other system an image can be readjusted indefinitely. The same objection applies to all lens projection systems, where the image is frozen onto a film.

DESIGN AND THE QUALITY OF IRIDESCENCE.

There is no better way to stretch a thin budget or to obtain the maximum benefits from a limited amount of lighting equipment and control than by iridescent imagery. The more illumination built into the set, the less general lighting is required, resulting in the lighting of the stage for the actor, rather than in subjecting the actor to a barrage of floodlighting on its way to illuminate the set. A quality of luminosity is achieved either by projections, back or translucent, by luminous panels worked into window and lantern design, or by sharply angled floodlighting placed near highly textured materials. Twilight, night or early morning scenes are especially effective because of the natural motivations for lighting fixtures, such as interior glow through set openings, campfires, low shafts of sunlight, moon radiance and horizon glow.

In the construction of lanterns, use a tubular frosted lamp in a large cylinder of both frost and colored gelatins or plastics, with Fruit of the Loom or Bates off-white fine cotton fabrics for the lantern panels. This will provide a soft, diffuse glow that will not glare in the eyes of the audience. In luminosity, one strives for area rather than point source of light.

Goose-neck lamps over which plastic color has been taped make excellent units for illuminating smaller window panels, preferably of the same material as that used for lanterns and translucent panels. Always be sure the illuminating source is offset from the direct line of vision through the panel cloth or else the source will show. If there is a choice of position, use the lower one so that the glow will be strongest at the base of the panel.

Dawn and dusk transitions can be handled effectively by the placement of a number of floods near an object such as a round tower. Cf. Illustrations I and III. Instead of an overall change of illumination, the general lighting simply may be dimmed or brightened and the quality of the effect may be controlled by the one particular flood whose illumination falls upon the extremely telltale surface. Roundness or angularity of this surface dissembles the exact nature of the lighting device.

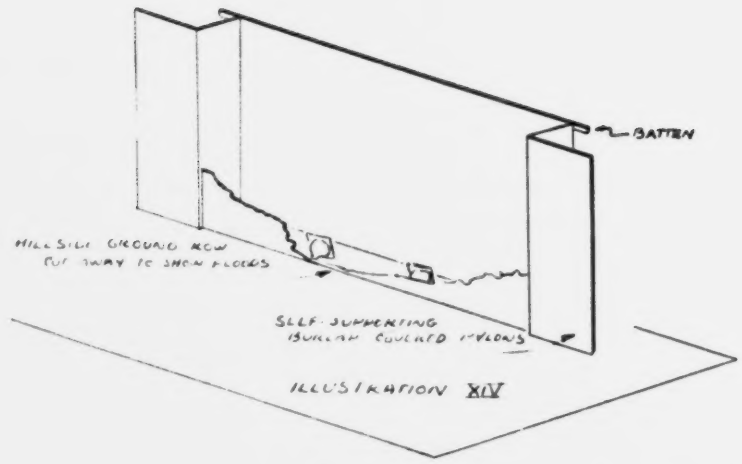
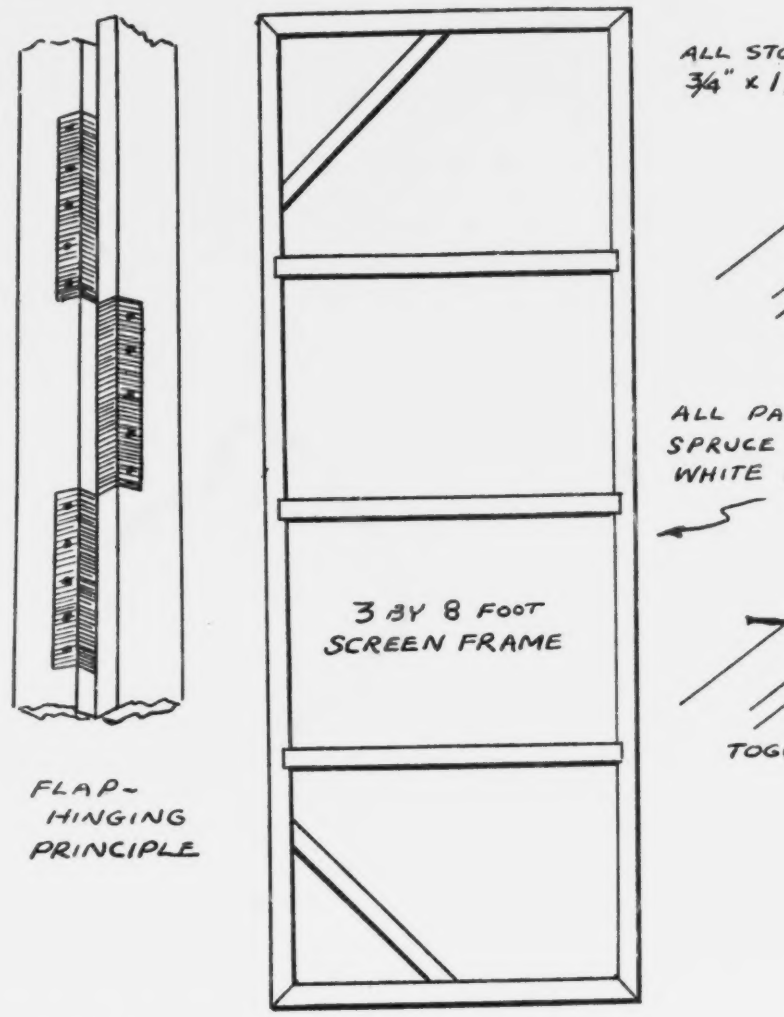


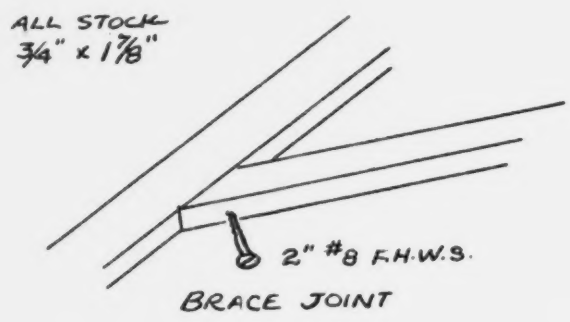
ILLUSTRATION XIV

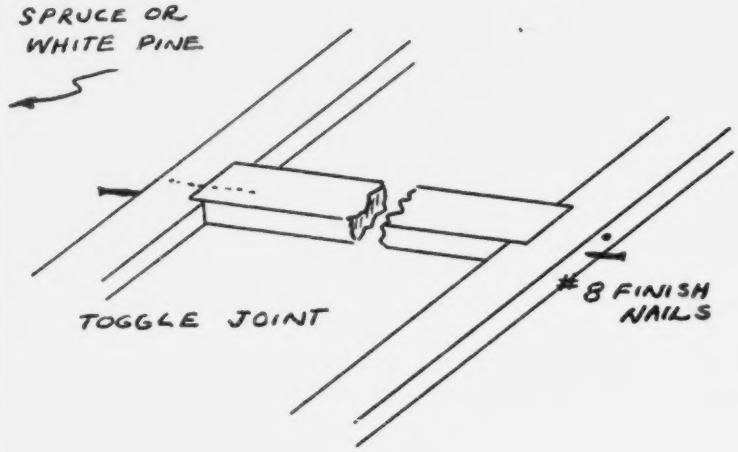
PORTABLE CYCS OR BACKGROUNDS.

Unless a play group is in possession of a completely equipped theatre, the need of a good background surface is paramount. Even the professional theatre with its wrinkled muslin sky pieces is not immune to this need. I have always felt that a little bit of a good background is superior to a large but poor background. Also, most children's theatre groups tour extensively, and there is nothing more awkward than attempting to hang backcloths under trying conditions.

(A) Illustration XIV shows a complete background unit, with the two burlap pylons at either end, a 16 foot batten between supporting the Indian Head backcloth, also stretched and tacked temporarily between the pylons, and a ground row to the front, masking the horizon floodlights. This unit is but 9 feet high and is entirely floor-based. That the background does not surround the playing area is of little importance. From a study of children's sketches of plays in retrospect, the particular area of a sky has yet to be recorded accurately.







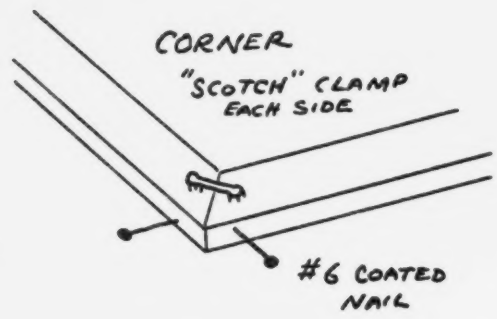


ILLUSTRATION XV

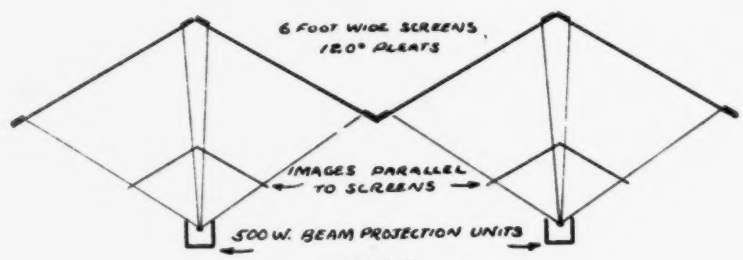
(B) A second method for creating portable backgrounds is by the arrangement of frankly architectural screens, either opaque or translucent. Illustration IX shows a pleated screen unit complete with illumination from the rear. To use material directly from the bolt without waste or sewing, I make my screens 3 feet wide. Burlaps make excellent opaque covering, combined with an underlayer of #60 heavy Kraft paper. When completed, the entire screen unit can be sprayed with flameproofing solution. Screens in accordion-pleated patterns have several advantages: they are self-supporting, easily adapted to various placement demands, and seem to minimize such illusion-breakers as light spill and shadows, unavoidable under difficult touring conditions.

(C) Because good screens, in multiple fold arrangements, are so essential to children's theatre on the move and so responsive to the application of light from simple, economical units, I am showing in Illustration XV one method of constructing, joining and surfacing screen units. This method is the result of 20 years experimentation in lightweight and flexible forms. The same construction, with variations in the internal structure, is suitable for both opaque surfaces or translucent panels. In the latter case, the upper toggles and braces are absent, with all bracing in the bottom panel. The method of flap-hinging shown requires no hardware and secures a continuous crack-free joint, as well as permitting double-action.

It will require a little practice to manufacture these screens with any degree of accuracy and efficiency. I am listing a few pointers. By setting the rip fence of a bench saw at 1-7/8 inches I can obtain 6 strips from the standard 1 by 12 inch board. No. 2 Spruce or better, Ponderosa or Idaho white pine woods are essential if splitting at the corners is to be avoided. Also the softer woods are essential for easy stapling. Tight toggle notch joints are to be desired. Assemble the frame without securing any parts to the work table or floor, standing on that part of the frame you are working on. This will allow the frame to slip around under impact, yet permit the joints to close. If the 45° mitred ends are accurate, the frame will align itself. Secure the corners to the work table or floor with light nails, however, when attaching the braces. The 6 penny coated nails recommended for the mitred corners are made from smaller gauge wire than other 6 d. nails and substitutions are not recommended.

The procedure in covering is shown in the large detail drawing of a cross-section of the stiles at the fold. Since the cloth-flap hinges alternate in position, the surfacing of the stile edges with the same material is necessary. These strips are 3 inches wide. After the 60 lb. heavy Kraft paper is applied, staple down these masking strips. Then lay out two screens side by side, place the flap hinges in offset pattern and tack down. These flaps can be cut 4 in. wide by 9 in. long. Turn the screens over, pull up the loose ends of the flaps, push the screens tight together, and complete the tacking down. The last operation is the stapling down of the surface cloth itself. Carry this material around the edges of all long sides not involved with hinging. The material should not be carried around the bottom edge, nor the top, either, if it is not seen.

(D) It is possible to form larger translucent panels by sewing the fine cotton cloth together with a plain seam. The sewing should be straight and quite near the edges. It is then necessary to stretch and set the cloth on the frame in such a way that the seam runs straight and true. This is accomplished by placing a taut string over the panel at the intersection of the seam, to use as a guide line when stapling down the sides of the cloth.



PLAN
ILLUSTRATION XVI

By relating the above illustration to Illustrations IX and X, it will be a simple matter to arrange for a self-supporting series of screens which will serve as a translucent, back-projected cyclorama, with 6 foot screen panels, possible 9 feet high, and requiring no more than 6 feet of depth in plan for all the parts. Two of the #79033 Beam Projection Units are shown. I have used four of these units on one particular occasion, with a folding screen of eight panels. Since the total current load on this combined unit was but 18 amperes and since the projected background was not changed during the act, I plugged the circuit into a nearby utility outlet, leaving the Rover units for more valuable lighting control. The images were formed of gelatin mosaics put together with thin strips of transparent "Scotch" tape. Always use saturated colors rather than tints when preparing these composite images. The more intense colors, even though technically dimmer, hold up better against acting area light and other frontal interference.

OPEN STAGE DESIGN.

An important result of the propositions in the section above is the freeing of backgrounds and obviously all scenic items from the particular hanging equipment or framing devices of a theatre. The chief difference between sets for the open stage and sets for the proscenium theatre is precisely this, that

those for the proscenium fill the framed opening both to the sides and above, while those for the open stage do not, but terminate in space. Thus, by building your sets and especially your backgrounds as floor-based, self-supporting units you can move a production from theatre to theatre with no difficulty. For especially large stages, a few additional architectural screen units will "cover" entrances and exits, and also your wing lights.

PORTABLE SCRIMS.

Next to backdrops, a large expanse of scrim is the most difficult scenic item to handle in the theatres not properly rigged or tracked. For extreme portability I have used framed panels of window screen wire, 4 by 9 feet. The screens are built of 1 by 4 lumber, laid on edge, rather than in the manner of conventional framing, and are hinged to fold or stand by themselves in angled positions, the wire and frames being sprayed black. To these are attached foliage cutouts or other effects. With these plus some platforms and stumps, woodland scenes are created easily. By inserting circuits of the high voltage, intermittently firing type of Christmas tree lights, firefly effects are achieved.

COLOR MEDIA.

There are two principal types of color media for the toning of illumination today, gelatin and plastic, both stocked by Hub. Gelatin is susceptible to moisture. However, it is cheaper and its range of colors greater. Gelatin should be stocked for experimentation and for image materials. For established uses, plastic is superior.

Based on the ROVER System of equipment, I am listing a minimum working order of Cinemoid plastics for general lighting and Brigham gelatines for image compositions. These may not be exactly what each group may require but at least they cover old favorites and new I have found useful.

For BACKGROUNDS, with aqua or water green Indian Head, Cinemoid #15 (Peacock Blue); for charcoal gray burlap, #32 (Medium Blue).

For OVERHEAD FLOODS, for toning the acting area, Cinemoid #3 (Straw); #38 (Pale Green), #34 (Golden Amber) and #16 (Blue Green).

For SPOTLIGHTS, in the front of stage position, Cinemoid #53 (Pale Salmon), #17 (Steel Blue) and #36 (Pale Lavendar); for tormentor accent and backlighting, #4 (Medium Amber), #9 (Light Salmon), #11 (Dark Pink) and #42 (Pale Violet).

For PROJECTION, in toning the beam, Brigham #3 (Flesh Pink), #17 (Special Lavendar), #25 (Daylite Blue), #29 (Special Steel Blue), #44 (Medium Blue Green), #53 (Very Light Straw), #54 (Light Straw) and #62 (Light Scarlet); for image complexes, #8 (Deep Pink), #13 (Rose), #14 (Rose Purple), #22 (Royal Purple), #35 (Dark Sky Blue), #46 (Dark Blue Green), #51 (Medium Lemon), #56 (Dark Straw), #59 (Amber), #61 (Orange) and #64 (Light Red).

STAGE AND AUDITORIUM
PLANNING SERIES ARTICLE NO. 5

This is another of a series of articles written by outstanding authorities in the field of theatre design and stagecraft for distribution to architects, engineers, and educational theatre directors and technicians. The Hub Electric Company trusts that the information contained in this article will help those who are planning new theatres, who are remodeling existing theatres, and who are considering the purchase of new or additional equipment to obtain the most flexible arrangement of space and the most satisfactory equipment. The Hub Engineering Department will be happy to make recommendations regarding the arrangement of space on the stage and the kind of lighting control equipment that will be appropriate for a particular installation.

HUB ELECTRIC COMPANY, Inc.—2255 WEST GRAND AVENUE—CHICAGO 12, ILLINOIS